GLAST Monthly PSR

Spacecraft

September 11, 2004 – October 6, 2004

Joy Bretthauer
Observatory Manager

Contract Actions

- Modification 32 to implement the UCA for POAL & S-band was composed, reviewed, and approved by GSFC legal and procurement. The modification was sent to GD/SASS for signature. Notification on 10/5/04 was received that signature is contingent upon "government deeming the S-band antenna & hybrid coupler as non-credible single point failures" and was accompanied by a draft CCR.

- Negotiations completed: Additional Ops CDRLs;

- Invoices received: a) Task 15 POAL; b) Task 17 S band; and c) Deliver Order Milestone – Initial Flight Software checkout w/ C&DH

- ROMs Received: a) SADA,APA, and cable wrap life-cycle testing; b) POAL/S-band implementation;

- In response to GD/SASS's request to change the PDR CDRL approval change from "approval" to "information", a contracts letter was sent to describe the PDR-version CDRL approval process.

- Proposals Received: Termination proposals for Special Studies Tasks 7 MECO, 12 Solar Array Kapton Qualification, & 13 Independent Safe Mode Processor (updated)

- Milestone acceptance criteria: Bus Manufacturing Readiness Review- information was located in RSDO regarding acceptance criteria; additional visit necessary to obtain more

Accomplishments: S/C Subsystems

- **Structures & Mechanisms:**
  - *Primary Structure -Upper ring extrusions assembly in work due in this week. Optical Bench Skirt in work.*
  - *Qualification testing activities for flight structure to start this month.:*
  - *Solar Array Substrates-New solar cell qualification test panels required for EMCORE; Updating substrate design and refreshing quotes;*
  - *MAR Deviation draft waivers: random vibe (optical bench, heat pipes); sine vibe (solar arrays)*
- **EPS:**
  - *Chassis – Complete; PRU sent to manufacturing; LCBs- All tested with New FPGA Code; CTB-EM in Test; CCB-EM in manufacturing; BBB- EM tests completed; PDU Backplane- Flight Board Design has been Re-spun; VRB –complete (DC-DC converter: New Lot is Being Built in Santa Clara, delivery to be in Oct); FSB-Complete; PIB/SIB/Backplane/Chassis – flight PIB & SIB complete; GBM Test Harness manufacturing is complete & it's in testing; LAT Test Harness complete;*
  - *Eagle Picher I&T battery is in assembly*
  - *EMCORE Solar Welds:*
    - ***Status: Three Test Coupons Being Cycled (5000 Cycles Completed);***
      - ***Baseline experienced 9 Failures***
      - ***No failures for other 2: No Adhesive Under Diode and Kapton Covered Diode Interconnect***
    - ***Plan: Test A,B, & C test coupons up to 28,000 cycles to evaluate front-side, coupon fixes. ATJ cell panel will be made & cycled to qual front & back sides. Assessing cost for ATJM panel fab & cycle for front & backside qual. Schedule is being re-worked to assess impact on flight solar array.***

Accomplishments: S/C Subsystems

- **C&DH:**
- ***Loaded and Executed CPU With Initial FSW Code, Successfully Demonstrated Uplink and Downlink Functionality*** *(RAD750 Running FSW Verified COP-1 and CCSDS Functionality; Successfully Verified Interrupts From UDL and PACI)*
- ***Performed Initial Testing on SSR Command & Telemetry Interface***
- ***Generated TLM database for HW RT telemetry***
- ***Generated several Labview displays for IEM box checkout***
- ***SEAKR SSR***
  - ***Flight Unit Environment tests on hold pending ASIC investigation and FPGA resolution***
  - ***Issue1: Investigating PAPI ASIC Failure Seen on SEAKR's EMs (EM Delivered 5/13/04;)***
  - ***Issue2: Control board has two S version FPGAs, one was programmed with old algorithm, and one with new algorithm***
  - ***ROM received for detailed FPGA/board SEAKR Review***
  - ***RECOMMENDATION: Set up TIM to review PAPI ASIC failure & SEAKR plan for S FPGA & ASIC***
- ***BAE RAD750***
  - ***Two EM's Delivered 6/13/03; Two Flight Units Delivered 8/16/04***
  - ***Issue: Heatsink separated from PWB and adhesive on four boards when thermal cycled. May need to rework boards to increase Heatsink roughness from 5-6 RMS (roughness micron scale) to 40-80 RMS. Awaiting BAE resolution***
- *Due to backplane re-work for address lines, C&DH schedule is being scrubbed to absorb impacts for flight IEM delivery.*
- *Issue: Proceeding with Flight Build & Test on Boards Affected by FPGA Problem by Using Industrial Temp Non-Flight FPGAs. LGIO has the non-flight FPGA installed. Other boards that will be affected are: UDL, PACI, NVM, LGIO, GPIO, ARM. MCDR RFA received to consider going directly to flight to minimize board re-work.*

Accomplishments: S/C Subsystems

- **FSW:**
  - *Mark Kunda(GLAST on-site QA) witnessed initial FSW IEM integration test (09/15/04) and signed memo to support milestone.*
  - *Completed code walkthroughs of current block of code*
  - *SSR: Completed integration of playback and record of stored telemetry in RAM and the SSR*
  - *Started integration of GNC auto-generated code into FSW*
  - *Networking: RAMIX network card is communicating with RAD750; VxWorks debugging tools communicate with RAD750 over the network*
  - *Reintegrated FSW with RAD750 in new backplane*
- **RF Comm:**
  - *Ku-band transmitter solder weld joint failure – Project to perform additional testing; Requesting that GD assist project in obtaining samples from CMC. GD has requested that GPO Define Requirements for # of Cycles, and Pass/Fail Criteria, for Indium/Lead Solder Joint Qualification. Cost Impacts Will be Determined..*
  - *GDC4S-SASS Analysis Shows GLAST Antennas Meet 90% Coverage Requirement; Answers were sent to Ken Hersey (GSFC) Regarding S-band Antenna Coverage*
  - *MMT Waiver Requests: 1) Input Voltage Range (SN101-TVAC), 2) VTMT on MMT EM*
  - *RF Cable Losses - Compatibility Testing: GD requested clarification for Cable Type & who supplies*

Accomplishments: S/C Subsystems

- **GNC:**
  - *APA, cable wrap, & SADA: ROM received & additional clarification requested;*
    - ***SADA: ATP is on-hold, Waiting For Strain Relief Parts***
  - *Accepted Subcontracts: Reaction Wheels, Magnetometers*
  - *Provided 1st Cut of GNC Code For Flight Software Build, Along With Interface Definition*
  - *Continued Work on GLAST Simulation*
  - *Plans: Preparing For GNC / FSW Code Integration*
- **Thermal:**
  - MAR Deviation draft waivers submitted: TVAC (TAM, ETR, GPS antenna, GPS Receiver, heat pipes, Ku-band antenna, propulsion, S-band antenna, solar array).
  - *MSFC Still Working on Getting Detector's #4 and #6 Into the Desired Temperature Range (Currently ~5°C Too Warm)*
  - *Prop System Thermostats: Only 11 out 50 Meet Drift Requirements; 8 Week Delay to Get Remainder of Order (~11/28/04); Unknown ARC Impacts Due to a Delay of Delivery*
- **Instrument Interfaces:**
  - GBM Test Harness fabrication is complete & in testing.
  - LAT Test Harness QAR: Use of WD40 rendered it incompatible for TVAC. Cleaned per NASA standards. GLAST Materials lead/Fred Gross has concerns that were forwarded to GLAST Contamination lead for review. GD has no plans for additional cleaning; procedure was used on other programs and was compatible with TVAC.

Accomplishments: S/C Subsystems

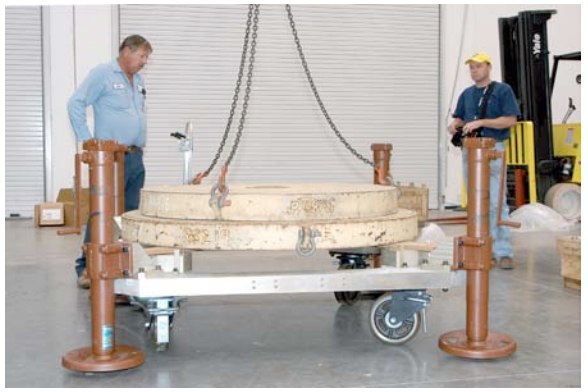
- **Propulsion:**
  - Corrosion in Propellant Feed Assemblies- The presence of rust (I.e. iron oxide) confirmed on the thruster chambers. The most likely root cause is Cl contamination from open hydrochloric acid bottle in clean room. Lead time for new assemblies is 5 months. Cleaning efforts with hydrazine was not effective enough. Mechanical removal through EDM of effected surfaces will be attempted.
  - THERMAL ANALYSIS: An independent assessment by GDC4S has discovered that some heaters are undersized and temperatures are below the 10°C minimum. ARC has incorporated the GD suggestions and design resolutions are in process.
  - THRUSTER VALVE QUALIFICATION
    - *All Mechanical Loads and Cycle Testing Complete*
    - *Currently Completing 9 of 12 Thermal Cycles*
    - *Burst Test 10/11/04 (Planned)*
    - *Report 10/20/04 (Planned)*
  - Thermostats – Drift of the open/close points noted in final ATP. Root cause theory is a bad lot of bi-metal material. New parts due in ~ 8 weeks. Impact is TBD. Other options are being investigated.
  - Structural Analysis:
    - **Random Vibration and Shock Cases are in process - Final Results Were Anticipated by 9/9/04. GDC4S has started an independent effort to perform the random vibration analysis**
  - ***A draft Preliminary Analysis Report with static load cases (all three axis) was received on 8/18/04. Copies forwarded to Mark Underdown, Structural Analysis and Systems Engineering Groups.***

Accomplishments: S/C Subsystems

- **Mechanical GSE:**
  - *Structure Assembly Tool / Integration Stand Tool is delivered.*
  - *QA Inspection complete*
  - *Proof Loading complete*

Tool Proof Load

- **On the Jacks**



Tool Proof Load

- **On the Wheels**

Spacecraft Milestones

Milestone		Due Date
Propulsion: Complete Acceptance Test Thrusters	In-progress	8/30/04
Start of GNC/FSW Code integration		8/30/04
MIWG at Huntington Beach, CA	*COMPLETE*	8/30/04
Optical Bench in Test		9/30/04
Flight GBM Harness assembled	*COMPLETE*	9/30/04
EM Uplink/Downlink testing complete		9/30/04

Rolling Wave Schedule

Discrepancies & errors were identified in the recently received 8/04 schedule and were reported to GD/SASS for resolution. GD/SASS has made some corrections and will be transmitting an update. (e.g. – Ku band dates were obsolete; GBM PD & DPU integration were 2/27/06 – 3/3/06 instead of 11/15/05; etc.)

PREVIOUS SCHEDULE	*Start*	*End*
- ***SC CDR:***	***5/24/2004***	***5/27/2004 (completed)***
- ***Flight Structural Tests (as of 8/04):***	*11/1/04*	*12/21/04*
- *[Previous Start-10/21/04 ; End- 12/10/04; GD/SASS is re-assessing to mitigate TPAF conflict.]*		
- ***SC I&T:***	*12/13/2004*	*8/24/05*
- ***End SC I&T to start Obs I&T:***	*7/19/05*	*11/15/05*
- ***Observatory I&T:***	*11/1/05*	*12/27/06*
- *GBM integration:*	*11/22/05*	*12/2/05*
- *LAT integration:*	*12/1/05*	*1/6/06*
- ***Pre-Ship Margin:***	*9/7/06*	*12/11/06*
- ***Pack EGSE & Observatory:***	*12/12/06*	*12/18/06*
- ***Ship to Launch Site:***	*12/19/06*	*12/27/06*
- ***Launch Site Operations:***	*12/28/06*	*2/28/07*
- ***Launch & Early Orbit Support:***	*2/28/2007*	*3/2/07*
- *SC & Observatory Checkout*	*3/5 –3/9/07 (SC)*	*3/10-4/13/07 (Obs)*
- *Observatory Acceptance Review*	*4/16/07*	

CDRL Reviews

CDRLs 29 & H: Pending GD/SASS responses to CDRLs 29 & H and evaluation are necessary prior to project's approval. Project comments compiled, consolidated, and forwarded to GD/SASS for response. CDRL I comments are compiled & require consolidation prior to forwarding.

GD/SASS to complete CDR-version CDRL deliveries, excluding two (2) Launch Vehicle (LV)-related CDRLs, by sending electronic versions. Electronic versions are necessary for project distribution via NGIN. LV-related deliveries were impacted by availability of GD/SASS LV-lead. Recommendation is to tie the 2 LV CDRLs to a future major milestone so that the last 10% of performance milestone payment may be granted. Note: LV contract is not in place yet.

- ***CDRL approval schedule is being updated based upon GD/SASS prioritization input. Upon completion, schedule will be distributed.***
  - *To expedite project approval, the subject matter-point of contact for each CDRL is responsible for preparing, communicating, and obtaining responses from GD/SASS. Sorting, filtering, and prioritizing comments (with Beverly's, Joy's, & systems assistance.)*

Issues: New

- ***LAT Test Harness: Assembled with WD40 and was incompatible for TVAC. GD/SASS cleaned the harness per NASA standards. Materials expert/Fred Gross has additional concerns which are being reviewed by GLAST's contamination lead/Chris L. GD/SASS states that methods were used in previous programs & that methods exceeded NASA standard.***
- ***FPGAs: S-part Actels impact S/C flight board assembly. CDR RFA received to consider going directly to flight FPGAs instead of using Industrial, non-flight FPGAs on flight boards.***
- ***SSR: SEAKR EM SSR has experienced ASIC failures which cannot be re-produced at Honeywell . None of the failures occurred in the flight SSR.***
- ***Propulsion: Corrosion in propellant feed assemblies due to hydrocloric acid in clean room. Hydrazine cleaning did not remove rust. Mechanical removal will be employed. Lead time for new assemblies is 5 months.***

- ***PREVIOUS:***
- ***TAAs: Spectrum to complete & submit to the State Department; Status – Drafts were composed & presented at the LAT Monthly. GD/SASS working with SLAC to identify expected personnel for Observatory I&T and launch support.***
- ***Thermal Control & Ku-band: Need to Stow Ku Band Antenna in Safe Modes to Ensure Battery Duty Cycle Remains Below 80% ; systems impacts are being assessed;***
- ***LAT Test flexures: Closed.*** *Flexures & documentation will be shipped to SLAC this week (10/08/04). Paul Baird assessed flexures and SLAC is expected to perform additional tests prior to integration & use. (previous: LAT (Martin N.) will define load cases & SAI will evaluate to see if suitable; Spectrum's concern is that they are qualifying them for the flight environment & not specifically to envelope the extremes of LAT's vibration test environment; SAI will be qualifying in the December timeframe;)*

Issues: Previous

- ***Diagnostic Telemetry Usage Decision: LAT & GBM may require additional telemetry that may impact the S/C FSW; a drop dead date from the s/c needs to be identified to know when this will start impacting S/C I&T***
- ***GFE List: A draft CCR is composed & instrument-related actions are being closed prior to submitting the CCR for CCB action. (previous: Spectrum to assess relevant GFE updates for only outstanding items from previous CCR; CCR will be updated & re-submitted;)***
- ***DC/DC Converter: Re-work scheduled for July 7, 2004; 3rd try for correct wire bond placement/pull;***
- ***Flight Rad750: SRAM with 4 address lines shorted; testing is being done to see if parts were stressed (outputs), if so then they will be delivered***
- ***RAD750: radiation, performance reduction***
- ***Optical Bench Struts: Design for Demise change from composite to titanium due to schedule; over any orbit the STA shouldn't vary more than +/- 3 degrees C; study results evaluating pointing algorithm (GN&C) may change STA orientation;***
- ***Factory of the Future: I&T: All facilities are checked out; CNOFs; does not mimic GLAST load cases; rotation device also doesn't mimic the GLAST load case;***

a. ***Conflict in EMI between NFIRE &GLAST for component level testing; chart 109***

b. ***Current Conflict Between CNOFS and GLAST Structural Qual Testing; chart 110; 11/17 – 12/10 for the vibe chamber for GLAST***

- ***c. Thermal: Minor Conflict Between GLAST Component Testing and NFIRE; Only 1 or 2 Days***
- ***FPGA & detailed board reviews [C&DH, EPS]: C&DH FPGA reviews continue. EPS FPGA reviews are now ready for review. Most materials are accessible & posted on Private Website. GD/SASS has stated that the ".adb" file will not be made available to the project for review.*** *[previous: Due to delayed and limited availability of designs, the project has limited time to complete peer reviews of FPGAs and board designs.]*

Issues: Previous

- ***Power on at Launch: Mod 32-UCA is at GD/SASS for signature. An RFP will be issued.*** *(previous -Study completed; UCA in-progress to implement. Study in progress to determine system impacts and configuration of components to be powered on at launch.)*
- ***S-band antenna switching: Also included in Mod 32-UCA which is at GD/SASS for signature.*** *(previous - Study completed; UCA in-progress to implement. Study defined to examine a simpler, more robust antenna design to replace current switching baseline.)*
- ***SSIRU spec reliability: Closed. NG to perform TVAC and random vibe w/ power on to protoflight levels. (previous - Subcontractor review revealed that there was insufficient flowdown of project MAR test requirements. GSFC GNC to assist with assessing Spectrum's test program and qualification for SSIRU; Recommendations to be made to ensure a credible qual program exists***
- ***MAR & test requirement compliance: Spectrum submitted a draft list of MAR waivers to the project for review. [previous: Spectrum & project QA are working together to assess Spectrum's compliance with the project's Mission Assurance requirements.]***
- ***SC accommodation of LAT over-voltage protection: EPS solution in review; [Note: 7/04 - PRU roadshow completed & final report released; data under review]***
- ***GFE PAFs: Closed.*** *Conflict with other programs resolved. TPAF will be available 10/15 – 12/3/04. [previous: TPAF need date is 10/21 to 12/10/04 for structural qual testing; NPP(Ball) requires it from 10/1/04 for 6 weeks; there is a 3 week overlap;]*
- ***Solar Array Diode Weld: RE-OPENED. Review at EMCORE on July 15, 2004. Diode to Cell Interconnect Appears to be Source Of Problem;*** *[previous: Replacement of low energy welds using the improved weld schedule did not correct the previous problem. Now, after thermal cycling, some bypass diodes are opening intermittently & some are constant .]*

Issues: Previous

- ***EMI/EMC Test Requirements: A draft CCR is being composed to reflect GD/SASS current EMI/EMC test program (component-level). (previous: Discrepancies in EMI/EMC testing presented in the peer review and the 2/24/2004-EMI/EMC proposal were identified. Tech evaluation, based on SC CDR is in-progress.)***
- ***Observatory Shipping container: Closed.****Decision to stay with baseline primarily driven by cost. [Baseline de-mating of solar arrays for shipping have led to internal-project discussions for alternate means of transport.]*
- ***Hiatus period activities: direction to Spectrum on-hold until detailed schedule is analyzed to determine length of hiatus after impacts due to instrument delays, CDR slip, Ku-band, ISMP, and launch date are assessed***
- ***36 SOW CDR requirements: 7 items are significantly affected by CLA/STOP results; Peer reviews determined that designs were conservative and risk for primary structure acceptable. [10/6/04: See STOP Cycle 3 status in systems presentation.]***
  - *Cost/schedule/technical impacts may result from hardware build based on pre-mature instrument models. If hardware build starts after CDR, risk of mods to hardware to accommodate results of true, CDR instrument & S/C models after final Coupled Loads Cycle is complete; Risk determined low based on SC CDR information*
  - *CLA cycles 1 & 2 are based on PDR-version of LAT FEM*
  - *At least 7 revisions of LAT FEM since PDR-version*
  - *Interface loads have increased 30%*
  - *Primary load path of LAT to S/C interface changed significantly*
  - *L/V CLA Forcing Functions are scaled, results not yet available*
- ***GPS Antenna: Closed. Extend lifetime due to thermal CTE mismatch***